perty of considerable age is free from the various bark and root diseases so prevalent throughout the East. We believe that on most plantations there are plenty of affected specimens to be found if the staff is free to search for them. We have generally found that the keener the managers and assistants are the larger the number of cases reported in the usual monthly statement."

It is a matter for consideration as to whether the term "Scares" should be applied to the recording of these diseases which are obviously always with us but only occasionally reported, according to the opportunity the scientist has to investigate them or as they assume undue prominence. They may probably provide a "Scare" for the outside man who is nervous and over anxious about his investment but they should hardly be considered in that light by competent experienced managers for with the assistance of these same scientists who record these diseases, they should feel quite capable of dealing with them and holding them in check.

T. F. Chipp.

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## Tuba-Root (Derris elliptica).

As an Insecticide.

Readers of George Maxwell's "In Malay Forests" will recollect the graphic account of a fishing expedition where the Malays used the root of the Tuba-plant as fish poison.

Many plants exist in the Tropics, and notably in India, which can be put to the same purpose of killing fish, and Watts' Dictionary gives a fairly long list of them. Throughout the Malay Archipelago Tuba-root appears to be the poison most in use, and a very effective one it is in the hands of expert natives.

The interesting question arises whether the toxic properties of this root are also effectual for the destruction of insect life; for, if such were the case, its application to agriculture is naturally all indicated.

The Chinese appear to have solved the question to their satisfaction, for we know that they employ tuba extensively for the protection of their crops against injurious insects. In Sarawak, the Chinese pepper planters always have, or had (for the writer's visit dates far back) a few bushes of tuba growing alongside their vines.*

Beyond that knowledge, however, the enquiry suggests itself whether the macerated tuba-root, as used by the Chinese, acts as a stomach-poison to chewing insects, when taken with their food, as it does in the case of grasshoppers and beetles, or as a contact poison for insects which obtain their food by sucking as bugs and plant-lice generally do, or whether its toxicity is effective both as a contact and a stomach poison.

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* Tuba-root is now largely grown in Singapore.

The "Journal of Agricultural Research" of 15th August, 1919 published by the Secretary of Agriculture, Washington, has under the title "*Derris as an Insecticide*" an exhaustive article on the subject, and some of its tests and conclusions are given below.

But first, to prepare the ground, the writer may be permitted to give his own experience in the use of tūba-root in the course of his cultural work.

A believer in the orthodox standard sprays and emulsions found in text-books, the writer had only once casually tried tuba-root and that without any notable result. He gave it no further thought until, in the presence of the wholesale and persistent destruction of his bean-plots under the attacks of "*Agromyza phaseoli*" he was persuaded to give tuba a thorough and well controlled trial.

"*Agromyza phaseoli,*" a fly, deposits its eggs under the skin of the stem of the beans, a very few days after germination of the seeds; the larvae feed on the tender tissues of the stems just below the first pair of leaves: the skin a week or so after germination, turns from green to brown and on pressing with the fingers, it is found to be hollow: the leaves fade and drop, and on splitting open the little stem, the small yellow larvae are found imbedded in the destroyed tissue.

Every plot was attacked and such is the virulence of this pest that it is quite an exception for one plant in 20 to survive. Among the many remedies employed against the pest were the following:—

Steeping the seeds in a 5% solution of corrosive sublimate. Rubbing the young stems with lime and powdered sulphur. The application of tobacco dust. Rubbing the seeds in sifted earth sprinkled over with "neem-oil" and putting some of this earth in each hole at the time of sowing.

The last device, alone, proved, to some extent, effective—about 20% of the plants being saved.

A trial of tuba was then made on a field of 8 beds, 66 feet long, with 1056 seeds of Lima Bean (Small Siéva) on the 28th October 1919. Ten ounces of tuba-root were well pounded in a wooden mortar, the juice thoroughly expressed, and the fibre exhausted in 20 gallons of water.

Tuba-water was then applied to each young plant at the rate of a cigarette tin full to 4 plants, morning and evening. This was continued for 15 days, until the plants were sufficiently established to be past all danger, which is only present during the first stage of their existence, when the stem is quite tender.

Only 16 seeds failed to germinate and of the 1040 plants that came up, not one has since died. And to-day, the plot is showing the most vigorous growth, a living testimony to the potency of the tuba-root as a plant-insect killer.

A point worthy of notice is that the "*Agromyza*" fly is there still quite manifest, and every morning, it can be seen in numbers flitting round and about the plants which it still damages to some extent: the pest has not died, but it has been completely prevented from laying its eggs in the young stems. The saving of the leaves, which it perforates to a state of fine lace, is not, by any means, an easy matter, but failing tuba-root, it is hoped, by means of sulphur dustings in the early mornings, gradually to overcome it.

The Tuba-plant "*Derris elliptica;*" in Malay *Akar Tuba,* a leguminose, may be seen growing in the Economic Gardens, as a low bush, but it is a climbing plant with a short trunk and long trailing branches. The root system is extensive and among the bundles of "*akar tuba*" sold in Chinese shops, pieces of root 8 feet long are not uncommonly found. In digging for roots in the Economic Gardens, the longest, so far found, was 5 feet in length: this shortness may be due to the unsuitability of the soil in which it grows—a soil too sandy to retain moisture in hot dry weather. According to a Chinese informant, tuba should be planted not far from water, which attracts the roots, thus favouring early development, and more frequent cuttings.

It is to be noted that the trials related in the Journal of Agricultural Research were made with dried imported roots, which implies, judging from the effects recorded, that it loses none of its potency by keeping.

Long tables are given in the course of the article with details of tests of tuba root applied as a dry powder and as a spray mixture with and without soap.

The following extracts are taken from this paper. A test was made of the effects of tuba as a contact poison on *Aphids,* with a spray mixture of 1 pound of powder to 100 gallons of water with the following results:

| Number of | Percentage of Aphids living on plants at the end of | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1st day | 2nd day | 3rd day | 5th day | 6th day | 7th day | 8th day |
| Aphids treated | | | | | | | |
| 182 | 52.2 | 24.7 | 10.4 | 4.4 | 2.2 | 0.5 | 0.5 |
| 150 | 25.3 | 22.6 | 7.3 | 2.0 | 2.0 | 0.0 | 0 |
| 209 | 19.1 | 11.0 | 9.0 | 8.1 | 5.7 | 3.3 | 2.8 |
| 172 | 33.7 | 20.3 | 23.2 | 19.7 | 19.7 | 18.6 | 12.7 |
| Average | 35.0 | 19.6 | 12.7 | 8.5 | 7.4 | 5.6 | 4.0 |
| Aphids untreated 159 | 96 | 105.6 | 104.4 | 137.1 | 144.6 | 169.7 | 235.2 |

TEST WITH TUBA POWDER USED AS A DUST.

| Number of | Precentage of Aphids living on the plants at the end of | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st day | 2nd day | 3rd day | 4th day | 6th day | 10th day | 13th day | 15th day |
| Aphids treated | | | | | | | | |
| 96 | 43.7 | 36.4 | 31.2 | 16.6 | 3.1 | 0.0 | 0.0 | 0.0 |
| 157 | 38.4 | 21.0 | 6.3 | 2.5 | .6 | 0.0 | 0.0 | 0.0 |
| 111 | 49.5 | 29.7 | 11.7 | 9.0 | 4.5 | .9 | .9 | 0.0 |
| 235 | 47.6 | 31.0 | 16.5 | 15.3 | 9.7 | 1.2 | .4 | 0 0 |
| | 44.8 | 29.5 | 16.4 | 10.8 | 4.5 | 0.5 | 0.3 | 0.0 |
| Aphids untraeted. | | | | | | | | |
| 180 | 103.3 | 128.3 | 146.1 | 179.4 | 231.6 | 315.5 | 315.5 | 3155+ |

These tables (two out of many) are followed with the remark:

"Reference to the two tables shows that the percentage of untreated "Aphis" gradually increased from the first day of the "tests onward. The increase was due to the birth of new "Aphids on the untreated plants. Aphids were also born on the "treated plants from the time the insecticide was applied, until "the reproducing mothers had died. Since, practically, all the "Aphids on the treated plants were dead at the close of the tests, "the newly born young ones must have been killed by coming in "close proximity to the particles of powder still remaining on the "plants."

EFFICIENCY OF "TUBA" AS A STOMACH POISON AGAINST VARIOUS INSECTS.

*Potato Beetle larvae.* Tuba used in various strengths up to 1 pound of powder to 128 galls. of water was found very effective. Practically all larvae were killed within 48 hours. Applied as dust the tests were equally conclusive.

*Tent Caterpillars.* All mixtures varying in strength from one pound to 8 gallons of water to 1 pound to 200 gallons were found effective.

Apple--tree branches were thoroughly sprayed and, after the foliage had dried, 20 to 40 newly hatched larvae were placed on each branch. The caterpillars began to show signs of discomfort within 48 hours and were practically all dead in from 5 to 10 days. In no case, was any material amount of feeding observed. In a second series of tests the larvae were placed on the branches and

sprayed after they had begun to form their tents. Under these conditions, sprays containing one pound of powder to 50 gallons of water and 1 pound to 100 gallons, killed all the larvae within 24 hours. When 1 pound to 200 gallons and 1 pound to 400 gallons of water were used, all the larvae were not killed within 11 days, but the few which remained alive were very small and inactive.

Used as a dust, this material killed all the treated larvae within a week.

*Oak-Worms.* Two small oak trees, on which about 300 caterpillars (*Anisota Senatoria*) were feeding, were sprayed thoroughly with Tuba at the rate of 1 pound of powder to 25 gallons of water: soap was added at the rate of one pound to 50 gallons, and a knapsack-sprayer was used. Within 24 hours, the larvae became inactive and ceased to feed, and at the end of 6 days no living ones could be found. As a check on this test, powdered arsenate of lead was applied at the rate of 1 pound to 50 gallons of water, and almost identical results were obtained.

*Hyphantria Cunea* (caterpillars which weave a web inside which they work, devouring the foliage enclosed). The caterpillars about one third grown, were killed within a week by a spray of 1 pound of powder to 5 gallons of water. Mixtures ranging from 1 pound to 50 gallons to 1 pound to 200 gallons of water were not satisfactorily effective, since nearly all of the sprayed foliage was eaten and not all of the caterpillars were killed.

*Datana larvae.* Two apple-trees, on which large colonies of nearly full-grown apple datanas (*Datana ministra*) were feeding, were sprayed with Tuba at the rate of 1 pound to 50 gallons of water. Twenty-four hours later, one living larva was found on one tree, and two on the other tree. The ground under the trees was thickly sprinkled with dead larvae.

*Cabbage Worms.* Applied at the rate of 1 pound to 25 gallons of water all the larvae in two cage-tests were killed within 24 hours.

Methods were employed to trace the tuba-powder and spray mixtures in the bodies of insects and the results show that tuba powder dusted upon insects does not pass into the trachae, but a limited amount of it may lodge in the spiracles: in order that the vapours and exhalations from a spray be effective, it is necessary for the sprayed insects to carry some of the solution on their bodies, in order that the exhalation may pass into the spiracles in as undiluted a condition as possible. After being dusted the insects seem to swallow some of the power which later may act as a stomach poison. Soap solutions containing tuba extract pass freely into the spiracles and finally reach the various tissues, but probably the extract kills by first affecting the nerve-tissue. (The above physiological conclusions are based on microscopical examinations and chemical manipulations too long and too technical to be inserted in this paper).

CONCLUSIONS.

The preceding experiments, much abridged as they are here given, show that the toxic principle of the tuba-root kills insects by acting both as a contact and as a stomach poison. It kills some insects easily, and others with difficulty, but it usually acts slowly and seems to kill by motor paralysis.

The above tests were made under strict control at the Agricultural Boards Testing Laboratory of Vienna (Va). They put beyond dispute the efficacy of tuba-root as a plant-insect poison and give it a high place among agricultural insecticides.

E. MATHIEU.

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## The Angsana Tree.

Yet another avenue of the Angsana tree (*Pterocarpus indicus*) has succumbed to the "disease" that has already deprived this country of some of its finest avenues. It will be recalled by many how these avenues have disappeared one after the other, first the one on the sea front in Malacca, then about 1907 one hundred trees in Penang, followed by epidemics among these trees at Tapah, Kuala Kubu, Kuala Lumpor and Taiping. A short while ago the avenue along the sea front at Singapore was also swept away. At the end of May this year (1919) some trees at the end of an avenue at Tanglin Barracks, Singapore, began to show the well known symptoms. Four months afterwards the "disease" had advanced considerably along the Avenue, but not successively taking toll of every tree for occasionally one was omitted, but so many trees were affected that it was deemed necessary to cut the avenue down. A look-out was kept for fungi but there was no opportunity to make a detailed investigation of the tissues of the trees. The only fungus collected was one of the tropical varieties of *Polyporus* (*Ganodermus*) *lucidus,* sometimes a stipitate form and sometimes more unguiculate. This is interesting as the fungi formerly collected from these trees have been *Polystictus occidentalis,* Fr., *Polystictus floridanus,* Berk., *Schizophyllum commune,* Fr., and *Polystictus hirsutus,* Fr. So far no fungus has actually been observed in the tissue.

On the other hand it is understood that this tree is generally propagated by means of cuttings. Now there are some who hold that the reason of this tree dying off in the manner it does is a question of senile decay and not of disease. The theory put forward is that the age of the individual tree must be counted from the last time its stock was grown from a seed. It is quite likely this may be many generations and correspondingly a considerable number of years. It is also to be presumed that the avenues and groups of trees which die off at the same time, in the same localities, are planted from the same stock of cuttings and would therefore be approximately the same age. In view of this the following article taken from the Gardens Chronicle Vol. LXVI, No. 4111, page 190 is of interest.